AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently amended) A method for retrieving target objects stored in a relational database to which an object model is mapped, the method comprising steps of:

generating a retrieval query to read target objects for a collection of source objects, the collection of source objects having many-to-many relationships with the target objects, the collection of source objects and target objects being respectively stored in one or more source tables and target tables in the database, and the many-to-many relationship being defined in the database by using an intermediate join table of the source tables and the target tables, wherein the retrieval query is generated by:

obtaining a source expression tree relating to the collection of the source objects;

building a target expression tree defined by the many-to-many mapping including a join between the target tables and the join table;

combining the source expression tree and the target expression tree to produce a combined expression tree; and

generating the retrieval query based on the combined expression tree;

selecting join table information from the many-to-many join table relating to the collection of source objects and the target objects to enable matching of the target objects and the source objects using the join table information; and

retrieving the matched target objects by executing the retrieval query on the database;

wherein retrieving the matched target objects involves automatically generating the query, and wherein the matched target objects include only many-to-many target objects, whereby the matched target objects can be retrieved without requiring the user to provide an explicit list of the matched target objects.

2. (Original) The method as claimed in claim 1 further comprising steps of:

specifying batch readable relationships on a source query for reading the collection of source objects;

generating a nested query for reading related objects nested in the target objects;

appending query information of the target objects to the nested query; and

retrieving the related objects by executing the nested query.

3. (Canceled).

4. (Currently amended) The method as claimed in claim 1~~3~~ wherein the target expression tree building step obtains the target expression tree from mapping meta-data which contains information as to how object classes and relationships of the object model map to tables and foreign keys in the database.

5. (Original) The method as claimed in claim 4 wherein the target expression tree building step obtains the target expression tree from mapping

meta-data which includes a list of key and value pairs of the many-to-may join table.

6. (Original) The method as claimed in claim 1 wherein the selecting step comprises steps of:

executing the retrieval query on the database for reading the target objects;

obtaining target object information and join table information from the join table; and

appending the target object information and the join table information to the retrieval query.

7. (Original) The method as claimed in claim 6 wherein the join table information including foreign key values and the appending step appends the foreign key values to the retrieval query.

8. (Original) The method as claimed in claim 6 wherein the appending step appends the target table information and the join table information to a select clause of a select statement.

9. (Original) The method as claimed in claim 6 wherein the retrieving step comprises steps of:

obtaining the target objects; and

populating relationships of the source objects with the target objects by comparing a primary key value of each source object with a foreign key value of each target object using the foreign key values stored in the retrieval query; and matching each source object with matched target objects.

10. (Currently amended) A method for retrieving objects stored in a relational database to which an object model is mapped, the method comprising steps of:

obtaining nested specification information representing joins relating to a source object and related objects which are joined with the source object with multi-level relationships, the source object and related objects being respectively stored in one or more source tables and target tables in the database, and the multi-level relationship being defined in the database by using an intermediate join table of the source tables and the target tables;

obtaining parent query information representing a parent query for reading one or more parent objects at a parent level;

generating a nested query for querying objects of next lower level which is next lower than the parent level, wherein the nested query is generated by:

obtaining a source expression tree relating to the source object;

building a target expression tree defined by the multi-level relationship including a join between the target tables and the join table;

combining the source expression tree and the target expression tree to produce a combined expression tree; and

generating the nested query based on the combined expression tree;

appending to the nested query the parent query information and the joins using the nested specification information; and

retrieving the objects of next lower level by executing the nested query on the database;

wherein retrieving the objects involves automatically generating the nested query, and wherein the objects include only many-to-many target objects, whereby

the objects can be retrieved without requiring the user to provide an explicit list of the objects.

11. (Original) The method as claimed in claim 10, wherein the nested specification obtaining step obtains the nested specification information from mapping meta-data which contains information as to how object classes and relationships of the object model map to tables and foreign keys in the database.

12. (Original) The method as claimed in claim 10 further comprising a step of specifying batch readable relationships to the parent query for allowing batch reading of the related objects.

13. (Original) The method as claimed in claim 12, wherein the specifying step comprises a step of determining the batch readable relationships based on the nested specification.

14. (Original) The method as claimed in claim 10 further comprising a step of setting automatic batch reading for automatically generating the nested query for reading objects of lower levels.

15. (Canceled).

16. (Canceled).

17. (Currently amended) A computer ~~retrieval~~ system for retrieving target objects stored in a relational database to which an object model is mapped, the computer ~~retrieval~~ system comprising:

a query generator for generating a retrieval query to read target objects for a collection of source objects, the collection of source objects having many-to-many relationships with the target objects, the collection of source objects and target objects being respectively stored in one or more source tables and target tables in the database, and the many-to-many relationship being defined in the database by using an intermediate join table of the source tables and the target tables, wherein the query generator generates the retrieval query by:

obtaining a source expression tree relating to the collection of the source objects;

building a target expression tree defined by the many-to-many mapping including a join between the target tables and the join table;

combining the source expression tree and the target expression tree to produce a combined expression tree; and

generating the retrieval query based on the combined expression tree;

a join table information handler for selecting join table information from the many-to-many join table relating to the collection of source objects and the target objects to enable matching of the target objects and the source objects using the join table information; and

a batch reading handler for retrieving the matched target objects by executing the retrieval query on the database;

wherein retrieving the matched target objects involves automatically generating the query, and wherein the matched target objects include only many-to-many target objects, whereby the matched target objects can be retrieved without requiring the user to provide an explicit list of the matched target objects.

18. (Canceled).

19. (Canceled).

20. (Currently amended) The computer ~~retrieval~~ system as claimed in claim 17, wherein

the join table information handler obtains target object information and join table information from the join table; and

the batch reading handler appends to the retrieval query target object information and the join table information.

21. (Currently amended) The computer ~~retrieval~~ system as claimed in claim 20, wherein the join table information handler obtains foreign key values.

22. (Currently amended) The computer ~~retrieval~~ system as claimed in claim 21, wherein the batch reading handler appends the foreign key values to the retrieval query.

23. (Currently amended) The computer ~~retrieval~~ system as claimed in claim 22, wherein the batch reading handler has a comparator for comparing a primary key value of each source object with a foreign key value of each target object using the foreign key values appended to the retrieval query; and matching each source object with matched target objects.

24. (Currently amended) A computer ~~retrieving~~ system for retrieving objects stored in a relational database to which an object model is mapped, the computer ~~retrieval~~ system comprising:

an information receiver for obtaining nested specification information representing joins relating to the source object and related objects which are joined with the source object with multi-level relationships, the source object and

related objects being respectively stored in one or more source tables and target tables in the database, and the multi-level relationship being defined in the database by using an intermediate join table of the source tables and the target tables;

a query generator for generating a nested query for querying objects of next lower level to parent objects which are queried by a parent query, wherein the query generator generates the nested query by:

obtaining a source expression tree relating to the source object;

building a target expression tree defined by the multi-level relationship including a join between the target tables and the join table;

combining the source expression tree and the target expression tree to produce a combined expression tree; and

generating the nested query based on the combined expression tree; and

a batch reading handler for appending to the nested query information of the parent query and the joins using the nested specification information, and retrieving the objects of next lower level by executing the nested query on the database;

wherein retrieving the objects involves automatically generating the nested query, and wherein the objects include only many-to-many target objects, whereby the objects can be retrieved without requiring the user to provide an explicit list of the objects.

25. (Currently amended) The computer ~~retrieval~~ system as claimed in claim 24, wherein the information receiver obtains the nested specification information from mapping meta-data which contains information as to how object

classes and relationships of the object model map to tables and foreign keys in the database.

26. (Currently amended) The computer ~~retrieval~~ system as claimed in claim 24, wherein the batch reading handler has a batch reading setter for allowing batch reading of the related objects.

27. (Currently amended) The computer ~~retrieval~~ system as claimed in claim 26, wherein the batch reading setter specifies batch readable relationships to the parent query for allowing batch reading.

28. (Currently amended) The computer ~~retrieval~~ system as claimed in claim 27, wherein the batch reading setter determines the batch readable relationships based on the nested specification.

29. (Currently amended) The computer ~~retrieval~~ system as claimed in claim 26, wherein the batch reading setter sets automatic batch reading for automatically generating the nested query for reading objects of lower levels.

30 (Canceled).

31. (Currently amended) Computer media storing the instructions or statements for use in the execution in a computer of a method ~~method~~ for retrieving target objects stored in a relational database to which an object model is mapped, the method comprising steps of:

generating a retrieval query to read target objects for a collection of source objects, the collection of source objects having many-to-many relationships with the target objects, the collection of source objects and target objects being

respectively stored in one or more source tables and target tables in the database, and the many-to-many relationship being defined in the database by using an intermediate join table of the source tables and the target tables, wherein the retrieval query is generated by:

obtaining a source expression tree relating to the collection of the source objects;

building a target expression tree defined by the many-to-many mapping including a join between the target tables and the join table;

combining the source expression tree and the target expression tree to produce a combined expression tree; and

generating the retrieval query based on the combined expression tree;

selecting join table information from the many-to-many join table relating to the collection of source object and the target objects to enable matching of the target objects and the source objects using the join table information; retrieving the matched target objects by executing the retrieval query on the database;

wherein retrieving the matched target objects involves automatically generating the query, and wherein the matched target objects include only many-to-many target objects, whereby the matched target objects can be retrieved without requiring the user to provide an explicit list of the matched target objects.

32. (Canceled).

33. (Currently amended) A computer program product executing within ~~for use in the execution in~~ a computer a ~~of~~ method for retrieving target objects stored in a relational database to which an object model is mapped, the product comprising:

a module for generating a retrieval query to read target objects for a collection of source objects, the collection of source objects having many-to-many relationships with the target objects, the collection of source objects and target objects being respectively stored in one or more source tables and target tables in the database, and the many-to-many relationship being defined in the database by using an intermediate join table of the source tables and the target tables, wherein the module for generating the retrieval query generates the retrieval query by:

obtaining a source expression tree relating to the collection of the source objects;

building a target expression tree defined by the many-to-many mapping including a join between the target tables and the join table;

combining the source expression tree and the target expression tree to produce a combined expression tree; and

generating the retrieval query based on the combined expression tree;

a module of selecting join table information for the many-to-many join table relating to the collection of source objects and the target objects to enable matching of the target objects and the source objects using the join table information;

a module for retrieving the matched target objects by executing the retrieval query on the database;

wherein retrieving the matched target objects involves automatically generating the query, and wherein the matched target objects include only many-to-many target objects, whereby the matched target objects can be retrieved without requiring the user to provide an explicit list of the matched target objects.

34. (Currently amended) Computer media storing the instructions or statements for use in the execution in a computer of a method for retrieving objects stored in a relational database to which an object model is mapped, the method comprising steps of:

obtaining nested specification information representing joins relating to the source object and related objects which are joined with the source object with multi-level relationships, the source object and related objects being respectively stored in one or more source tables and target tables in the database, and the multi-level relationship being defined in the database by using an intermediate join table of the source tables and the target tables;

obtaining parent query information representing a parent query for reading tone or more parent objects at a parent level;

generating a nested query for querying objects of next lower level which is next lower than the parent level, wherein the nested query is generated by:

obtaining a source expression tree relating to the source object;

building a target expression tree defined by the multi-level relationship including a join between the target tables and the join table;

combining the source expression tree and the target expression tree to produce a combined expression tree; and

generating the nested query based on the combined expression tree;

appending to the nested query the parent query information and the joins using the nested specification information; and

retrieving the object of next lower level by executing the nested query on the database;

wherein retrieving the objects involves automatically generating the nested query, and wherein the objects include only many-to-many target objects, whereby the objects can be retrieved without requiring the user to provide an explicit list of the retrieved objects.

35. (Canceled).

36. (Currently amended) A computer program product executing within ~~for use in the execution in~~ a computer a ~~of~~ method for retrieving objects stored in a relational database to which an object model is mapped, the product comprising:

a module for obtaining nested specification information representing joins relating to the source object and related objects which are joined with the source object with multi-level relationships, the source object and the related objects being respectively stored in one or more source tables and target tables in the database, and the multi-level relationship being defined in the database by using an intermediate join table of the source tables and the target tables;

a module for obtaining parent query information representing a parent query for reading one or more parent objects at a parent level;

a module for generating a nested query for querying objects of next lower level which is next lower than the parent level, wherein the module for generating the nested query generates the nested query by:

obtaining a source expression tree relating to the source object;

building a target expression tree defined by the multi-level relationship including a join between the target tables and the join table;

combining the source expression tree and the target expression tree to produce a combined expression tree; and

generating the nested query based on the combined expression tree;

a module for appending to the nested query the parent query information and the joins using the nested specification information; and

a module for retrieving the objects of next lower level by executing the nested query on the database;

wherein retrieving the objects involves automatically generating the nested query, and wherein the objects include only many-to-many target objects, whereby the objects can be retrieved without requiring the user to provide an explicit list of the retrieved objects.